

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

**Fibre optic interconnecting devices and passive components – Performance standard –**

**Part 143-2: Optical passive VIPA-based dispersion compensator of single-mode fibre transmission for category C – Controlled environment**

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**Dispositifs d'interconnexion et composants passifs à fibres optiques – Norme de performance –**

**Partie 143-2: Compensateur de dispersion reposant sur le VIPA passif optique de transmission par fibre unimodale pour la catégorie C – Environnement contrôlé**



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## CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references .....	6
3 Terms, definitions and abbreviations .....	7
4 Test.....	8
5 Test report.....	8
6 Performance requirements .....	8
6.1 Reference components.....	8
6.2 Dimensions .....	9
6.3 Sample size .....	9
6.4 Test details and requirements .....	9
Annex A (normative) Sample size .....	17
Annex B (informative) Virtually imaged phased array (VIPA) Technology.....	18
Bibliography.....	20
Figure B.1 – Structure of virtually imaged phased array (VIPA).....	18
Figure B.2 – Detailed light path and mechanism of generating chromatic dispersion .....	19
Table 1 – Test and requirements for C-band and L-band WDM application .....	10
Table 2 – Test and requirements for C-band WDM application.....	11
Table 3 – Test and requirements for L-band WDM application.....	12
Table 4 – Common test and requirements .....	13
Table A.1 – Sample size .....	17

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**FIBRE OPTIC INTERCONNECTING  
DEVICES AND PASSIVE COMPONENTS –  
PERFORMANCE STANDARD –**

**Part 143-2: Optical passive VIPA-based dispersion  
compensator of single-mode fibre transmission for category C –  
Controlled environment**

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The text of this standard is based on the following documents:

FDIS	Report on voting
86B/3491/FDIS	86B/3535/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61753 series, published under the general title *Fibre optic interconnecting devices and passive components – Performance standard*, can be found on the IEC website.

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## INTRODUCTION

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# FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

## Part 143-2: Optical passive VIPA-based dispersion compensator of single-mode fibre transmission for category C – Controlled environment

### 1 Scope

This part of IEC 61753 contains the minimum test and measurement requirements and severity levels that a passive chromatic dispersion compensator (PCDC) using virtually imaged phased array (VIPA) must satisfy in order to be categorized as meeting the IEC standard, category C-controlled environments.

Generally, PCDCs are used to reduce the magnitude of chromatic dispersion (CD) between regenerators by adding CD to the span that has a sign opposite to the total CD of the fibre cable and components. The requirements cover non-connectorized PCDCs used in single-channel transmission and wavelength division multiplexing (WDM) transmission in single-mode fibres (IEC 60793-2-50 B1/B2/B4).

### 2 Normative references [standards.iteh.ai](http://standards.iteh.ai)

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60793-1 (all parts), *Optical fibres – Measurement methods and test procedures*

IEC 60793-2-50, *Optical fibres – Part 2-50: Product specifications – Sectional specification for class B single-mode fibres*

IEC 61300 (all parts), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures*

IEC 61300-2-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-1: Tests – Vibration (sinusoidal)*

IEC 61300-2-4, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-4: Tests – Fibre/cable retention*

IEC 61300-2-9, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-9: Tests – Shock*

IEC 61300-2-17, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-17: Tests – Cold*

IEC 61300-2-18, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-18: Tests – Dry heat – High temperature endurance*



IEC 61300-2-19, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-19: Tests – Damp heat (steady state)*

IEC 61300-2-22, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-22: Tests – Change of temperature*

IEC 61300-2-42, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-42: Tests – Static side load for connectors*

IEC 61300-2-44, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-44: Tests – Flexing of the strain relief of fibre optic devices*

IEC 61300-3-2, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-2: Examination and measurements – Polarization dependent loss in a single-mode fibre optic device*

IEC 61300-3-4, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-4: Examinations and measurements – Attenuation*

IEC 61300-3-7, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-7: Examinations and measurements – Wavelength dependence of attenuation and return loss of single mode components*

IEC 61300-3-32, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-32: Examinations and measurements – Polarization mode dispersion measurement for passive optical components*

IEC 61300-3-38, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-38: Examinations and measurements – Group delay, chromatic dispersion and phase ripple*

IEC 61753-1, *Fibre optic interconnecting devices and passive components performance standard – Part 1: General and guidance for performance standards*

IEC 62074-1, *Fibre optic interconnecting devices and passive components – Fibre optic WDM devices – Part 1: Generic specification*

### 3 Terms, definitions and abbreviations

For the purposes of this document, the following terms, definitions and abbreviations apply.

#### 3.1 Terms and definitions

##### 3.1.1

##### **chromatic dispersion**

CD

derivative of group delay with respect to wavelength or frequency

Note 1 to entry: A typical unit is ps/nm or ps/GHz. The chromatic dispersion generally varies with the operating wavelength.

##### 3.1.2

##### **polarization dependent loss**

PDL

maximum variation of insertion loss due to a variation of the state of polarization (SOP) over all the SOPs

### 3.1.3

#### wavelength dependent loss

WDL

maximum variation of the insertion loss over operating wavelength range

### 3.1.4

#### polarization mode dispersion

PMD

when an optical signal passes through an optical fibre, component or subsystem, the change in the shape and width of the pulse due to the average delay of the travelling time between the two principal states of polarization (PSP), differential group delay (DGD), and/or to the waveform distortion for each PSP, is called PMD

Note 1 to entry: PMD, together with polarization dependent loss (PDL) and polarization dependent gain (PDG), when applicable, may introduce waveform distortion leading to unacceptable bit error rate increase.

## 3.2 Abbreviations

CD	Chromatic dispersion
DGD	Differential group delay
FWHM	Full width at half maximum
PCDC	Passive chromatic dispersion compensator
PDL	Polarization dependent loss
PMD	Polarization mode dispersion
PSP	Principal states of polarization
SMF	Single mode fibres
SOP	State of polarization
VIPA	Virtually imaged phased array
WDL	Wavelength dependent loss
WDM	Wavelength division multiplexing

## 4 Test

All test methods are in accordance with IEC 61300.

The samples shall be terminated onto single mode fibres specified according to the relevant IEC classification for single mode fibres (SMF) (IEC 60793-1 series).

All tests shall be carried out to validate performance over the required optical pass bands, as defined in IEC 62074-1. Single or multiple pass bands corresponding to the PCDC specifications can be chosen for the qualification and differing target specifications may be assigned to each pass band.

## 5 Test report

Fully documented test reports and supporting evidence shall be prepared and be available for inspections as evidence that the tests have been carried out and complied with.

## 6 Performance requirements

### 6.1 Reference components

The testing for these components does not require the use of reference components.

## 6.2 Dimensions

Dimensions shall comply with either an appropriate IEC interface standard or with those given in appropriate manufacturing drawings, where the IEC interface standard does not exist or cannot be used.

## 6.3 Sample size

Sample sizes for the tests are defined in Annex A.

## 6.4 Test details and requirements

The requirements are given only for dispersion compensator. For connectorized components, the connector performances shall be in compliance with IEC 61753-1. Tables 1 to 4 give test details and requirements for these devices.

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**Table 1 – Test and requirements for C-band and L-band WDM application**

No	Tests	Requirements	Details
1	Chromatic dispersion deviation IEC 61300-3-38	Chromatic dispersion is specified for the operational wavelength range.  100 GHz spacing type  CD  < 500 ps/nm (FWHM; 50 GHz)  CD  < 1 200 ps/nm(FWHM; 40 GHz)  200 GHz spacing type  CD  < 400 ps/nm (FWHM; 60 GHz)  The deviation of chromatic dispersion: ≤ 5 % of the nominal chromatic dispersion value	The deviation of chromatic dispersion shall be determined as the worst case over the operational wavelength range.
2	Insertion loss IEC 61300-3-4 IEC 61300-3-7	≤ 9,5 dB (not including the optical circulator)	Fibre lengths of PCDC pigtail: ≥ 1,5 m.  The insertion loss shall be determined as the worst case over the operational wavelength range.
3	PDL IEC 61300-3-2 Method 1	≤ 0,6 dB	The PDL shall be determined as the worst case over all polarization states for the operation wavelength range.
4	WDL IEC 61300-3-4 IEC 61300-3-7	≤ 1,5 dB	Fibre lengths of PCDC pigtail: ≥ 1,5 m
5	PMD IEC 61300-3-32	≤ 0,8 ps  CD  < 500 ps/nm ≤ 1,5 ps  CD  < 1 800 ps/nm  CD is the nominal chromatic dispersion with a unit of ps/nm.	The PMD shall be determined as the worst case over all polarization states for the operation wavelength range.
NOTE Operating wavelength range: C-band 1 530 nm to 1 565 nm, L-band 1 565 nm to 1 625 nm.			

**Table 2 – Test and requirements for C-band WDM application**

No	Tests	Requirements	Details
1	Chromatic dispersion deviation IEC 61300-3-38	Chromatic dispersion is specified for the operational wavelength range.  100 GHz spacing type  CD  < 500 ps/nm (FWHM; 50 GHz)  CD  < 1 200 ps/nm(FWHM; 40 GHz)  200 GHz spacing type  CD  < 400 ps/nm (FWHM; 60 GHz)  The deviation of chromatic dispersion: ≤ 5 % of the nominal chromatic dispersion value	The deviation of chromatic dispersion shall be determined as the worst case over the operational wavelength range.
2	Insertion loss IEC 61300-3-4 IEC 61300-3-7	≤ 9,5 dB (not including the optical circulator)	Fibre lengths of PCDC pigtail: ≥ 1,5 m.  The insertion loss shall be determined as the worst case over the operational wavelength range.
3	PDL IEC 61300-3-2 Method 1	≤ 0,6 dB	The PDL shall be determined as the worst case over all polarization states for the operation wavelength range.
4	WDL IEC 61300-3-4 IEC 61300-3-7	≤ 0,85 dB  <a href="https://standards.iteh.ai/catalog/standards/sist/786551f8-3587-4866-a24f-907787390665/iec-61753-143-2-2012">https://standards.iteh.ai/catalog/standards/sist/786551f8-3587-4866-a24f-907787390665/iec-61753-143-2-2012</a>	Fibre lengths of PCDC pigtail: ≥ 1,5 m
5	PMD IEC 61300-3-32	≤ 0,8ps  CD  < 500 ps/nm ≤ 1,5ps  CD  < 1 800 ps/nm  CD is the nominal chromatic dispersion with a unit of ps/nm.	The PMD shall be determined as the worst case over all polarization states for the operation wavelength range.
NOTE Operating wavelength range: C-band 1 530 nm to 1 565 nm.			